MEPAG
E2E-iSAG

Report of the MEPAG E2E-iSAG – Introduction

Lisbon, Portugal; June 16, 2011

Dave Des Marais, MEPAG Chair

Pre-decisional: for discussion purposes only

Package 1 of 5

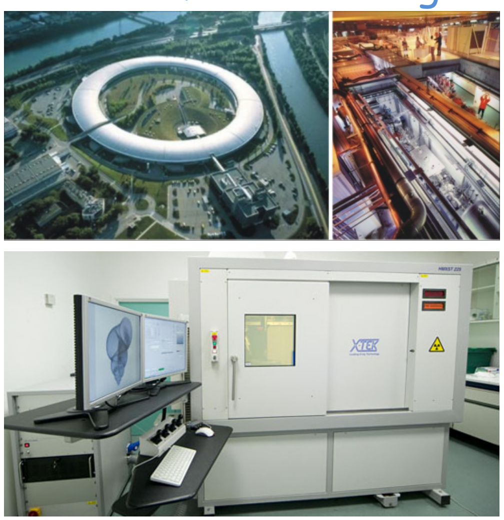
Sample Return is the Next Step

From ***<u>Vision and Voyages for Planetary science in the Decade 2013-2022:</u>***

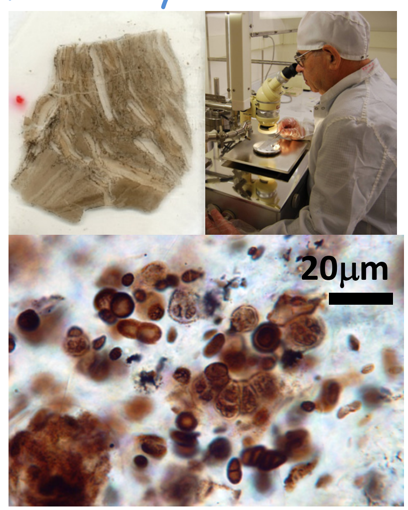
"The analysis of carefully selected and well documented samples from a well characterized site [on Mars] would provide the highest scientific return on investment for understanding Mars in the context of solar system evolution and addressing the question of whether Mars has ever been an abode of life."

Committee on the Planetary Science Decadal Survey;
National Research Council, March 2011

Reasons for returning samples for analysis on Earth…



Could use advanced instrumentation not amenable for flight to Mars.



Could employ techniques requiring complex sample preparation.

Could use a virtually unlimited array of different instruments, including future instruments not yet even designed.

Charter: The MSR End-to-End study

<u>Building on previous work</u> (NRC reports, ND-SAG, 2008; MRR-SAG, 2009; 2R-iSAG, 2010):

1. Propose reference campaign-level <u>MSR science objectives and priorities</u>
2. Understand <u>derived implications</u> of these proposed objectives and priorities:
   a) Kinds of samples required/desired
   b) Requirements for sample acquisition and handling
   c) Develop preliminary landing site selection criteria, and apply them to Mars to create some reference landing sites
   d) Capabilities required for adequate *in situ* characterization needed to support sample selection
   e) Propose returned sample analysis plans and priorities, including minimum required sample size to achieve all objectives

Note: The E2E analysis is delivered in the form of two parallel documents—a PPT-format summary (this document), and a text-format white paper. In case of discrepancies, the white paper should be judged to be superior.

The Team

Co-Chair	Mark Sephton	Imperial College, London, UK	Organics, ExoMars
	Scott McLennan	SUNY Stony Brook, NY	Sedimentology, geochemistry Co-I MER
Science Members	Carl Allen	JSC, Houston, TX	Petrology, sample curation, Mars surface
	Abby Allwood	JPL, Pasadena, CA	Field Astrobio., early life, liason MAX-C
	Roberto Barbieri	Univ. Bologna, IT	Astrobiology, paleontology, evaporites
	Penny Boston	NM Inst. Mining & Tech, NM	Cave geology/biology, member PSS
	Mike Carr	USGS (ret.), CA	Mars geology, water on Mars
	Monica Grady	Open Univ. UK	Mars meteorites, isotop., sample curation
	John Grant	Smithsonian, DC	Geophys., landing sites, MER, MRO
	Veronika Heber	UCLA	Gas geochemistry
	Chris Herd	Univ. Alberta, CAN	Petrology, sample curation
	Beda Hofmann	Nat. Hist. Museum, Bern, CH	Geomicrobiology, ExoMars (Deputy CLUPI)
	Penny King	Univ. New Mexico	Petrology, geochemistry, MSL
	Nicolas Mangold	Univ. Nantes, FR	Geology, spetroscopy MEX, MSL
	Gian Gabriele Ori	IRSPS, Pescara, IT	Mars geology, sedimentology, MEX, MRO
	Angelo Pio Rossi	Jacobs Univ. Bremen, DH	Planetary geology, HRSC, SHARAD
	François Raulin	Univ. Paris 12, FR	Astrobio., extraterrestrial material, Deputy MOMA
	Steve Ruff	Arizona State Univ.	MER operations, spectral geology, MGS, MER
	Barb Sherwood Lollar	Univ. Toronto, CAN	Astrobology, stable isotopes
	Steve Symes	Univ. Tennessee	REE, geocronology, member CAPTEM
Eng. Reps.	Peter Falkner	ESA	Advanced mission planning, MSR
	Mike Wilson	JPL	Advanced mission planning, MSR
Ex-officio	Dave Beaty	Mars Program Off., JPL	Liason to MEPAG, cat herder

Reviewers

EXTERNAL

1.	John Bridges	EU
2.	Dave Des Marais	US
3.	Fred Goesmann	EU
4.	Vicky Hipkin	CA
5.	Emmanuelle Javaux	EU
6.	Jeff Johnson	US
7.	Hap McSween	US
8.	Jack Mustard	US
9.	Jim Papike	US
10.	Caroline Smith	EU
11.	Andrew Steele	US
12.	Frances Westall	EU

INTERNAL

1. Jorge Vago
2. Charles Whetsel
3. Rich Zurek
4. Joel Hurowitz
5. Charles Budney

Mid-Term Assumptions

After March, 2011 (in response to changes on both sides of the Atlantic), NASA and ESA entered into negotiations for a joint rover 2018 mission.

<u>Current assumptions (of relevance to the E2E study)</u>

1. Single joint rover delivered by MSL skycrane system
2. The mission would support both Mars Sample Return science (based on science priorities updated via the E2E analysis) AND *in situ* science derived from prior ExoMars priorities.
3. Would include previously selected Pasteur payload. It is known that additional instruments for sample selection/caching would be required, and this is being analyzed by E2E-iSAG. Selection via a potential future joint AO is assumed.

Proposed MSR Science Objectives

The science objectives of the proposed MSR Campaign, organized by topic.

AIM	Objective
A. Life	Critically assess any evidence for past life or its chemical precursors, and place detailed constraints on the past habitability and the potential for preservation of the signs of life
B. Surface	Reconstruct the history of surface and near-surface processes involving water.
	Assess the history and significance of surface modifying processes, including, but not limited to: impact, photochemical, volcanic, and aeolian.
	Constrain the magnitude, nature, timing, and origin of past planet-wide climate change.
C. Planetary evolution	Quantitatively constrain the age, context and processes of accretion, early differentiation and magmatic and magnetic history of Mars.
	Constrain the origin and evolution of the martian atmosphere, accounting for its elemental and isotopic composition with all inert species.
D. Human exploration	Assess potential environmental hazards to future human exploration.
	Evaluate potential critical resources for future human explorers.

Additional: Determine if the surface and near-surface materials contain evidence of extant life

Transition to Mark